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**HIGH RESOLUTION DYNAMICS LIMB SOUNDER
(HIRDLS)**

**SYSTEM ENGINEERING SUPPORT,
SCIENCE AND ALGORITHM DEVELOPMENT,
AND SCIENCE COMPUTING FACILITY**

WORK BREAKDOWN STRUCTURE

EOS CHEMISTRY PROJECT

AUGUST 1999



**GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND**

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1. INTRODUCTION

This document describes the Work Breakdown Structure (WBS) and WBS dictionary used for the science and algorithm development and Science Computing Facility development for the EOS Chemistry Project.

2. WBS DICTIONARY

A01 Provide Scientific Direction: B/C/D

Provide scientific direction and guidance to instrument development effort; support/coordinate with EOS and ESDIS; participate in HIRDLS team meetings and reviews; update HIRDLS science documents as required; review instrument designs to ensure science requirements are met. This WP includes all Science travel necessary to accomplish the above.

AC U.S. Ground Data System

AC01 Meeting support: C/D

Personnel involved in the software development and operations support activities will be required to attend a variety of meetings including instrument liaison, HIRDLS Science Team, EOSDIS technical exchange, project reviews and liaison with UK SDP software developers.

AC02 Travel: C/D

Travel in support of technical meetings and reviews, software integration and test, and data processing operations support is included in this WBS element.

AC03 Report Preparation: C/D

Resources required to assemble materials for monthly and quarterly status reports and project reviews are included in this WBS element.

AC04 Data Processing Operations Support: C/D

This WP includes resources for staff to routinely review summary diagnostic information generated with each run of DAAC based SDP software to verify correct instrument and algorithm configuration and performance. Staff will also review summary diagnostic information produced by in-line Quality Assurance software running in conjunction with SDP software at the DAAC to establish that the resulting data products are correct regarding form and content. In addition, this group will be responsible for planning and configuring reprocessing requests and assisting in data product validation as required.

AC05 Software and Data Product Documentation Maintenance: C/D

Resources required to maintain end-user, on-line documentation regarding data access software, data product content and data product quality are included in this WBS element. Updates to documentation may be required to reflect improvements in data products resulting from reprocessing, changes in algorithms or changes in instrument operating characteristics.

AC101 NCAR Meeting support: C/D

This WP provides the funding for the Data Manager at NCAR to attend a variety of meetings including instrument liaison, HIRDLS Science Team, EOSDIS technical exchange, project reviews and liaison with UK SDP software developers.

AC102 NCAR Travel: C/D

Travel for NCAR in support of technical meetings and reviews, software integration and test, and data processing operations support is included in this WBS element.

AC103 NCAR Report Preparation: C/D

Resources for the Data Manager at NCAR to direct the preparation of monthly and quarterly status reports and project reviews are included in this WBS element.

AC104 NCAR Data Processing Operations Support: C/D

This WP includes resources for the Data Manager to supervise staff to routinely review summary diagnostic information generated with each run of DAAC based SDP software to verify correct instrument and algorithm configuration and performance. Staff will also review summary diagnostic information produced by in-line Quality Assurance software running in conjunction with SDP software at the DAAC to establish that the resulting data products are correct regarding form and content. In addition, this group will be responsible for planning and configuring reprocessing requests and assisting in data product validation as required.

AC105 NCAR Software and Data Product Documentation Maintenance: C/D

Resources for the Data Manager to supervise effort to maintain end-user, on-line documentation regarding data access software, data product content and data product quality are included in this WBS element. Updates to documentation may be required to reflect improvements in data products resulting from reprocessing, changes in algorithms or changes in instrument operating characteristics.

ACAA01 DAAC Science Data Product Software

This WP includes the work required to specify, design, develop, integrate, test and maintain the DAAC based SDP software.

ACAAA01 Version 2 Prod S/W (Engineering Version)

The Engineering version will be delivered 24 months prior to HIRDLS launch and will demonstrate all major functional capabilities and interfaces of the SDP software. This WP includes resources for the SDP software requirements review and update, data product interface maintenance, update of SDP software design and review, additional refinement of science prototype algorithms, refinement of SDP software modules and integration of the Engineering delivery package at the DAAC.

ACAAB01 Version 3 Prod S/W (Launch Version)

The Launch version will be delivered 12 months prior to HIRDLS launch and will represent a launch ready configuration of the SDP software. This WP includes resources for the final SDP software requirements review and update, data product

interface maintenance, final SDP software design and review, launch configuration of science algorithms, launch configuration of SDP software modules and integration of the Launch delivery package at the DAAC.

ACAAC01 Validated Mission Version

The Validated Mission Version represents the software configuration to be employed in the post-launch phase after initial algorithm and data product checkout and validation activities have concluded. This WP also includes those resources necessary to carry out SDP software maintenance during the flight phase of the mission.

ACAB Data Archive Support Software

This WBS element includes the resources required to format and verify HIRDLS standard, browse, metadata and special data products in accordance with EOSDIS/DAAC requirements

ACABA01 Data Product Quality Assurance Software

ACABB01 Special Data Product Software

ACABC01 Browse Product Software

ACABD01 Metadata Generation and Update Software

ACB NCAR Ground Data System

AD U.S. Science Computing Facility

ADA UCB Science Computing Facility

This WBS category defines the resources required for the USA PI to procure and maintain elements of the US Science Computing Facility (SCF) to be used to support SDP software development and maintenance, data processing operations, data product validation and data product research applications.

ADAA01 Software Definition Workstations

This WP includes the resources necessary to develop the initial SCF system necessary to carry out the initial SDP software requirements analysis and prototype science algorithm development. The system will also be used for instrument science and engineering trade-off studies. The system includes intermediate class UNIX workstations, desktop PC class systems, disk, backup devices, hard copy devices, design and analysis software and general system and utility software. Components of this initial configuration will be incorporated into subsequent system designations as required.

ADAB01 Software Development System

This WP includes the resources necessary to expand the SCF to support development of the Engineering SDP software deliveries. This system will include enhanced UNIX compute and file server support, expanded on-line storage, CASE tools, documentation and DBMS software, additional desktop systems and additional hard copy output capability. Components of this configuration will be incorporated into the "Mission Ready" system as required.

ADAC01 Mission Ready System

This WP includes the resources necessary to expand the SCF to support development of the Launch Version SDP software delivery and begin the post-launch phase of the mission. This will require additional computational resources as well as greatly expanded on-line, near-line and off-line data storage capacity. The system will be built up incrementally during the immediate pre-launch and post-launch to match demand. Resources are also included to allow obsolete equipment to be removed from service and replaced with updated systems

ADAD01 University of Washington Workstations

This WP identifies resources necessary to provide on-site facilities for Co-Investigators at the University of Washington which are compatible with the HIRDLS SCF and the EOSDIS DAAC. The UW SCF will be used to support data product validation activities and to carry out scientific research with HIRDLS data products. The system includes intermediate class UNIX workstations, desktop PC class systems, disk, backup devices, hard copy devices, and data analysis software.

ADAE01 Science Analysis Workstations

This WP identifies resources necessary to provide data analysis and display facilities for Co-Investigators at UCB which are compatible with the HIRDLS SCF and the EOSDIS DAAC. The Science Analysis Workstations will be used to support data product validation activities and modeling research with HIRDLS data products. The system includes intermediate class UNIX workstations, desktop PC class systems, disk, and data analysis software.

ADAF01 US Instrument Support Terminal (IST)

This WP identifies resources necessary to procure, develop and maintain the US IST within US SCF configuration. The IST will be used by Instrument Flight Operations staff to operate the HIRDLS instrument on-orbit and monitor instrument performance. Both the US and UK will maintain IST capability. Actual instrument operation responsibility will periodically rotate but both groups will monitor instrument performance on an on-going basis.

ADB NCAR Science Computing Facility

This WBS category defines the resources required to support procurement and maintenance of the US Science Computing Facility (SCF). The SCF will be used to support SDP software development and maintenance, data processing operations, data product validation and data product research applications.

ADBA01 Software Definition Workstations

This WP includes the resources necessary for NCAR to provide planning and system administration support in the installation of the initial components of the SCF.

ADBB01 Software Development System

This WP includes the resources necessary for NCAR to provide planning and system administration support to expand the HIRDLS SCF to support development of the Engineering SDP software delivery.

ADBC01 Mission Ready System

This WP includes the resources necessary for NCAR to provide planning and system administration support to expand the HIRDLS SCF to support development of the Launch Version SDP software delivery and begin the post-launch phase of the mission.

ADBE01 Science Analysis Workstation

This WP includes the resources necessary for NCAR to provide planning and system administration support to provide data analysis and display facilities for Co-Investigators at NCAR which are compatible with the HIRDLS SCF and the EOSDIS DAAC.

ADBF01 US Instrument Support Terminal (IST)

This WP includes resources necessary for NCAR to provide planning and system administration support to the PI in the development of the US IST within the US SCF configuration.

AF U.S. Science Support and Applications

AF01 CU Travel: C/D

Resources for travel to support US Science Support and Applications activities.

AF101 NCAR Travel: C/D

Resources for NCAR travel to support US Science Support and Applications activities.

AFAC CU Efforts on Science Plan Development

The Principal Investigator and the Co-Investigators will participate in the development of the Science Plan.

AFAD CU Efforts on Prototype Retrieval Algorithms

The PI will provide direction to the NCAR efforts to develop prototype retrieval algorithms. He will be assisted by an Experiment Scientist to refine the forward radiance models, refine the profile retrieval approach and refine the aerosol correction algorithms.

AFAE CU Efforts on Aerosol Retrievals

Under the direction of the HIRDLS PI, the Co-I (Toon) and other aerosol scientist(s) will work in the area of aerosol remote sensing, infrared radiative transfer in particulate-laden atmospheres, and physics and chemistry of aerosols. One of the new areas in which HIRDLS will advance beyond previous instruments is in sounding the upper troposphere and lower stratosphere. A key to this is the ability to measure and correct for aerosol effects, and to interpret the resulting aerosol data. Software to calculate aerosol, PSC, and cirrus scattering and extinction coefficients as a function of wavelength and composition will be developed, and provided to the retrieval

model software. HIRDLS data will be analyzed for amounts, distribution, and composition of particulates in the atmosphere.

AFAF CU Efforts on Support/Production Software

The Co-I (Avallone) will develop data on the climatology of trace species in the lower stratosphere/upper troposphere. Under the direction of the HIRDLS PI, provide the necessary resources to participate in the development of the production software. Included in this general activity is the generation of the transmittance database, parameterization of the transmittance, and development of required climatological data.

AFAG Reserved

AFAH CU Efforts on Atmospheric Modeling

Provide Modeling Scientist(s) and Programmer(s) support to HIRDLS Co-Is Boville and Brasseur in atmospheric modeling efforts, including atmospheric model development and atmospheric model data application studies.

AFAI Data Manipulation and Display Software

Provide programmer(s) support to the Science Team to develop data manipulation and display software.

AFAJ CU Efforts on Validation

AFAJ01 Validation Plan: C/D

The Principal Investigator, Co-Is and other scientists will participate in the development of the Validation Plan as required.

AFAJ02 Measurement and Validation Activities: C/D

The Principal Investigator will lead the effort to carry out the measurement and validation activities. Assisting will be Co-Is and other scientists. Activities will include the assimilation and analysis of correlative measurements, assimilation and analysis of ancillary data, participation in the on-orbit instrument validation and participation in the data validation.

AFAK CU Efforts in Data Analysis and Applications

The efforts of the Principal Investigator, Co-Investigators, Atmospheric Scientist, visitors, post docs and graduate students to analyze and apply the HIRDLS data are supported by WBS.

AFAL Prototype Algorithms for Special Data Products

Funding is provided for development of prototypes of special data product algorithms.

AFAM University of Washington Subcontract

Funds to support the University of Washington Subcontract are included here. Included specifically are the efforts of Holton and Leovy and their support staff, materials, supplies, travel and computing time.

AFBA01 NCAR Efforts on Instrument Oversight: C/D

Co-Is Mankin and Coffey will participate in the HIRDLS system design, in the development and review of specifications, documents, plans and procedures for all the appropriate system-related issues.

AFBA02 NCAR Efforts on Trade-off Studies: C/D

This WP is specifically for the efforts of the Instrument/RT Scientist and an Associate Scientist to undertake the appropriate trade-off studies for the instrument. Included are the development of a research instrument model/retrieval package, application of the research retrieval to support the engineering studies, and performance of a measurement capability analysis and the generation of an instrument-related error analysis.

AFBB01 NCAR Efforts on Calibration Plan: C/D

Co-Is Mankin and Coffey, and Instrument Scientists will participate in the development of the Calibration/Validation Plan as required.

AFBB02 NCAR Efforts on Instrument Calibration: C/D

Co-Is Mankin and Coffey, and Instrument/RT Scientist will participate in the Calibration/Validation of the HIRDLS instruments. Travel funds are allocated to support extended visits of USA HIRDLS staff in the UK to assist with the calibration activities

AFBB03 NCAR Efforts on Calibration Analysis: C/D

Co-Is Mankin and Coffey, Instrument/Retrieval Scientist(s), and Associate Scientist/Programmer will participate in the analysis of the data and instrument performance following the completion of the calibration activities.

AFBC NCAR Efforts on Science Plan Development

This WBS provides resources for the Co-Is to participate in the development of the Science Plan.

AFBD NCAR Efforts on Prototype Retrieval Algorithm Development

This WBS provides resources for the Retrieval Scientist, an Algorithm Scientist/Programmer, and an Associate Scientist/Programmer to refine the forward radiance models, refine the profile retrieval approach and incorporate the aerosol correction algorithms.

AFBE NCAR Efforts on Aerosol Retrieval

Under the direction of the HIRDLS PI, a Scientist will provide support to the CU Aerosol effort, and to the effort to develop aerosol extinction coefficients for HIRDLS channels for different sulfate aerosols, PSC's, and cirrus clouds.

AFBF NCAR Efforts on Production Software

The RT Scientist, an Algorithm Scientist/Programmer, and Data Scientist will participate in the development of data to support the production software. Included in this general activity is the generation of the transmittance database, parameterization of the transmittance, and development of required climatological data.

AFBG NCAR Efforts on Prototype Gridding Algorithms

Provide scientific input and Programmer(s) support to the HIRDLS development of the Prototype Data Gridding Algorithms.

AFBH NCAR Efforts on Atmospheric Modeling

Atmospheric modeling efforts, including atmospheric model development and atmospheric model data application studies, will be undertaken by Co-Is Boville and Brasseur.

AFBJ NCAR Efforts on Validation

AFBJ01 Validation Plan

All Co-Is will participate in the development of the Validation Plan as required.

AFBJ02 Measurement and Validation Activities

Under the direction of the HIRDLS PI, all Co-Is and participants will assist in the effort to carry out the measurement and validation activities.

AFBK NCAR Efforts in Data Analysis and Applications

The efforts of the Co-Is, Atmospheric Scientists, visitors, post docs, and graduate students to analyze and apply the HIRDLS data are supported by this WBS.

AH U.S. Instrument Flight Operations

AHA UCB Instrument Flight Operations

AHAA Flight Operations Plans and Procedures

Provide resources to support the generation of the Flight Operations Plans and Procedures under the direction of the HIRDLS PI and the Data Manager.

AHAB Flight Operations Software

Provide resources to support the generation of the Flight Operations Software under the direction of the HIRDLS PI and the Data Manager.

AHB NCAR Instrument Flight Operations

AHBA Flight Operations Plans and Procedures

Provide resources to support the generation of the Flight Operations Plans and Procedures under the direction of the HIRDLS PI and the Data Manager.

AHBB Flight Operations Software

Provide resources to support the generation of the Flight Operations Software under the direction of the HIRDLS PI and the Data Manager.